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Seasonal distribution and systematic study of Grasshopper (Acrididae) family: A regional study of Tehsil Ratodero, Sindh Pakistan

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Abstract

The Acrididae family's seasonal distribution and systematics are examined in detail in this study, with a particular emphasis on grasshoppers in Tehsil Ratodero, Sindh, Pakistan. The study uses thorough field surveys to identify and characterize six different species from five genera in the Acrididae family: *Acrida exaltata*, *Truxalis Eximia Eximia*, *Aiolopus thalassinus thalassinus*, *Acrotylus longipes longipes*, *Oxya velox* and *Acrotylus humbertianus*. The results highlight the ecological importance of these species, clarifying their functions in biodiversity, the financial consequences for agriculture, and their interdependence in the surrounding ecosystem. The research offers significant insights that address the complex dynamics of Acrididae in Tehsil Ratodero and contributes to both scholarly debate and practical pest management measures. With 29% of the population, Lashari had the most population, while Banguldero had the lowest, at 14%.

Keywords: Acrididae, grasshopper, seasonal distribution, species abundance, fauna

Introduction

Among the Acrididae, Grasshopper is one of the most well-known family. Orthoptera is an order of insects that is diverse and important to the environment. Hexapods and the Acrididae family of grasshoppers harm crops like rice and wheat cones in the agricultural sector. Real grasshoppers are members of the Acrididae family. With over 22,500 species worldwide, the order Orthoptera is one of the most diverse insect orders ^[1]. The primary focus of this study is on the seasonal distribution and systematics of Acrididae in Tehsil Ratodero, Sindh province, Pakistan. Within the larger Orthoptera order, the Acrididae family, commonly referred to as short-horned grasshoppers, is one of the most interesting and varied insect families ^[2, 3]. It is commonly recognized as the phylum Arthropoda's most significant subgroup in terms of its contribution to biodiversity enhancement and preservation. They are a major nuisance in agricultural and grassland areas across the world ^[4, 5] which are between 10 and 65 mm in size their habitats and body forms vary widely ^[6] which makes them a compelling subject for science research. The intricate morphology of this family emphasizes the need for a comprehensive study of it, particularly in Tehsil Ratodero's unique environmental situation. Acrididae is a major part of the large insect order Orthoptera ^[7] and it occupies a central place within its vast domain ^[8]. With Acrididae rising as a dominating family, especially in grasslands and agricultural areas ^[9] the investigation highlights the extraordinary variety within the Orthoptera ^[1]. In the setting of Tehsil Ratodero in Sindh, Pakistan, where the distinctive climatic circumstances may have generated ^[10] distinct patterns of grasshopper diversity and distribution, it is imperative to look further into the details of the Acrididae order ^[11]. The Acrididae family has been the subject of extensive research, but the systematic study and seasonal dynamics of these grasshoppers in specific geographic locations, like Tehsil Ratodero, remain generally ignored. This work provides insights into the intricate interactions that take place between Acrididae and its surroundings, thereby helping to address this information gap. The Acrididae family's adaptability and range of ecological roles are demonstrated by the length of their antennae, the presence of wings, and their auditory organs. One of the biggest orders of insects ^[12] Orthoptera is crucial to many different ecosystems ^[13].

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The vital role that grasshoppers play in enhancing the biodiversity of agricultural regions grasslands [2] and deciduous woods which role in biodiversity [14] Grasshoppers are important to the environment [15] not just because they are the main herbivores [16] but also because they are an important link in food chains [17], affecting a variety of animals such as birds, spiders, and reptiles [18]. Thus, appreciating the seasonal distribution and systematics of Acrididae [19, 20] is not just an academic endeavor but also an essential step in understanding and maintaining the fragile environmental balance.

Grasshoppers, especially those in the Acrididae family, are quite problematic in the agricultural setting [15, 21]. The significance of these pests economically, highlighting their potential to seriously harm pastures and crops [22]. The ability of Acrididae to assemble swarms and cause lasting damage [23] adds to their destructive capability [2]. Therefore, a thorough examination of their behaviors, preferred habitats, and the variables influencing their population dynamics is urgently needed [2].

In summary, our study on the systematics and seasonal distribution of Acrididae in Tehsil Ratodero, Sindh, Pakistan, has significant scientific and practical implications. The goal of this study is to shed light on the intricacies of their ecological roles, financial implications, and environmental connections in order to contribute significantly to the discourse in academia and pest management strategies.

Materials and Methods

Study area: My area of interest for the study is Ratodero. It is the sub-capital Tehsil of the Larkana District and is 28 kilometers from Larkana. 224,666 people are living there, covering an area of 53,283 square miles (2001). Nine Union Councils (Uc) are present.

Sample Collecting

The samples were taken in different parts of Tehsil Ratodero. Aerial nets and manual plucking were used in the process of collecting the species [24].

Killing and preservation

The gathered item was brought inside the laboratory and killed with potassium cyanide by being placed in an airtight plastic container. The specimens' color shift, particularly in the case of the green specimens, indicates that they were not immersed in cyanide for more than 10 minutes. [25].

Preservation of the Sample

The body components of the insects were placed on a stretching board and fastened correctly. The dried samples were stored in bug boxes and labeled with the name of the species, collector, and location label [26].

Identification of samples

Sample identification was accomplished with the use of Baloch (2002) and Wagan (1990) taxonomic keys. For each species that was reported, the valid name and range were provided [27]. Using a scale divider, measurements of the abdomen, forewing, and hindwing were made [28].

Genitalia Study

To dissect the genitalia, the desiccator was filled with water and six drops of alcohol, and the dried specimens were left there for a whole day. After a full day, the final portion of the abdomen was removed, and placed on a cavity slide, and any

remaining muscles were extracted using potassium hydroxide [29, 30].

The genitalia were preserved in glass jars with glycerin. On graph paper, genitalia were sketched in a line, traced on tracing paper, and then transferred to a computer [31].

Results and Discussions

Tehsil Ratodero undertook a thorough field survey to gather Acrididae fauna. A total of 324 specimens from the family Acrididae were gathered, and 06 species from 05 genera were recognized. The species included *Acrotylus longipes longipes*, *Acrida exaltata*, *Truxalis Eximia Eximia*, *Oxya velox*, and *Acrotylus humbertianus*. With 29% of the species, Lashari had the largest population, while Banguldero had the lowest, at 14% Table 1 shows the distribution of species in Tehsil Ratodero's different locales.

Furthermore, a study on the seasonal distribution of different species in several regions revealed that the occurrence of some species was higher in the spring and summer and lower in the winter. The spring infection rate is measured over a period of three months. During the month of March, we recorded normal field collections - not large or small, but sufficient - and during the two remaining months of April and May, we collected an enormous number of specimens from the field, as shown in Table 2. The fact that June, July, and August are also rainy months, the during the summer season was very high compared to previous seasons. However, because of the extreme heat, the collection was primarily found in the early morning and evening hours, as illustrated in the Table. 3 notably, very few specimens were taken; nevertheless, in September, the collection was determined to be normal. In October and November, the last two months of the season, the collection recorded very poor figures, which were nearly discovered during the sun's peak, shown in table 4.

Because of the extremely cold weather during this winter season, very little of these species were collected. In comparison to the other two months of the season, as indicated in Table 5. Very little was collected in the months of December and January, and very little was collected in February.

Further description is as follows;

1. *Oxya velox* (Fabricius, 1787)

Diagnostic characteristics

24-26 segmented, medium-sized, filiform antenna that is longer than the head and pronotum combined.

Pronotum longer than the head. Fasicutum's short, wide vertex is broadly rounded with a little depression in the center.

The pronotum curved with a sharp apex, wide at the base, three sulci crossed by the dorsum, and obtusely rounded posteriorly (Figure.1-a).

2. *Acrida exaltata* (Walker, 1859)

Large, elongated, and somewhat stick-like in size. The antenna has eighteen segments, ensiform, pronotum to gather, shorter than the head. The head is longer than the pronotum, conical, and elongated, with a little upward slope. Tegmina and wings are completely formed, and the latter are pointed apically. The hind knee lobes have sharp tips, and the hind femur is long and narrowly slim (Figure 1-b).

3. *Truxalis Eximia Eximia* Eichwald, 1830

The big, stick-like, elongated, pale line behind the eyes

extends to the pronotum and tegmina on either side of the head. The antenna with 18 segments that are ensiform and shorter than the head and pronotum combined. A longer, thinner pronotum with an angular posterior edge. Fully developed wings and tegmina, with sharply angled tips. thin, most elongated hind femur; three spines, including higher knee lobes; Centro-internal carina has a series of teeth. Each side of the hind tibia has a 25–28 black-tipped spine (Figure 1-c).

4. *Aiolopus thalassinus thalassinus* (Fabricius, 1781

Medium-sized, tiny body. Together with the pronotum, the 21–23 segmented filiform antennae are longer than the head. Smaller than the pronotum is the sub-conical head. Saddle-shaped pronotum, thin prozone, presence of median carinae, absence of lateral carinae.

Tegmina and wings are completely grown. The dorsal genicular lobe is rounded, hind femur is long.

The hind tibia has a narrow, thin spine with 10–11 black tips

on either side (Figure 1-d).

5. *Acrotylus longipes longipes*, (Charpentier, 1845)

Hairy, rugose, small to medium in size. With 23 segments, the antennae filiform are longer than the head and pronotum combined.

Head a little higher than pronotum but shorter overall. The angular, concave fastigium of the vertex has lateral carina. Present fastigial foveolae that are almost trapezoidal in form and have vertical frons (Figure.1-e).

6. *Acrotylus humbertianus* Saussure,1884

Medium-sized, with hair all over the body. With 24 segments, the antennae filiform are longer than the head and pronotum combined.

The head is somewhat higher and shorter than the pronotum. Vertex fastigium is angular, concave, and has a discernible lateral carina. Present, frons vertical, slightly faint fastigial foveolae (Figure 1-f).

Table 1: Shows the distribution of species in various localities of Tehsil Ratodero

Localities	<i>Acridida exaltata</i>	<i>Acrotylus longipes longipes</i>	<i>Acrotylus humbertianus</i>	<i>Truxalis eximia</i>	<i>Oxya velox</i>	<i>Aiolopus thalassinus thalassinus</i>	% of specimens
Lashari	26	13	15	12	17	14	29%
Maso Dero	15	12	13	8	14	7	21%
Naudero	17	11	14	4	6	7	18%
Allah Bux Hakro	8	10	9	11	8	5	15%
Banguldero	14	9	5	7	9	4	14%

Table 2: Displaying the Species Seasonal Distribution of Grasshoppers in the Spring

S. No	Species	Spring March, April & May
1.	<i>Truxalis Eximia Eximia</i>	++++
2.	<i>Acrotylus humbertianus</i>	++
3.	<i>Oxya velox</i>	++++
4.	<i>Acrotylus longipes longipes</i>	+
5.	<i>Aiolopus thalassinus thalassinus</i>	+++
6.	<i>Acrida exaltata</i>	++

Table 3: Displaying the Summer time Seasonal Distribution of Grasshopper Species

S. No:	Species	June, July & August
1.	<i>Truxalis Eximia Eximia</i>	++++
2.	<i>Acrotylus humbertianus</i>	++++
3.	<i>Oxya velox</i>	++++
4.	<i>Acrotylus longipes longipes</i>	++++
5.	<i>Aiolopus thalassinus thalassinus</i>	++
6.	<i>Acrida exaltata</i>	+++

Table 4: Displaying Grasshopper Species Seasonal Distribution in Autumn

S. No:	Species	September, October & and November
1.	<i>Truxalis Eximia Eximia</i>	++
2.	<i>Acrotylus humbertianus</i>	+
3.	<i>Oxya velox</i>	++
4.	<i>Acrotylus longipes longipes</i>	+
5.	<i>Aiolopus thalassinus thalassinus</i>	+
6.	<i>Acrida exaltata</i>	+

Table 5: Displaying Grasshopper Species Seasonal Distribution in Winter

1.	<i>Truxalis Eximia Eximia</i>	+
2.	<i>Acrotylus humbertianus</i>	+
3.	<i>Oxya velox</i>	+
4.	<i>Acrotylus longipes longipes</i>	-
5.	<i>Aiolopus thalassinus thalassinus</i>	-
6.	<i>Acrida exaltata</i>	-





Fig 1: Dorsal view of *Oxya velox-a*, Dorsal view *Acrida exaltata-b*, Dorsal view *Truxalis Eximia Eximia-c*, Dorsal view *Aiolopus thalassinus thalassinus-d*, *Acrotylus longipes longipes-e*, *Acrotylus humberianus-f*

Conclusions

The current investigation came to a close with the discovery of 06 species of grasshoppers from Tehsil Ratodero belonging to 05 genera. To determine the other species of grasshoppers from Pakistan's Sindh area, more study must be done.

Authors' Contribution: ShehrBano Mustafa, conducted the research and wrote the manuscript, Waheed Ali Panhwar made line drawings and captured the digital images, and Abdul Manan Shaikh data analysis.

Conflict of Interest: Authors have no conflict of interest.

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